TAXAN

SERVICE MANUAL

12″ COLOR DISPLAY

SUPER VISION IV/IV M™

SUPER VISION 630/640™

IMPORTANT SERVICE SAFETY INFORMATION

Super Vision IV/IVM
Super Vision 640/630

Operation of monitor outside of cabinet or with back removed involves a shock hazard. Work on these models should only be performed by those who are thoroughly familiar with precautions necessary when working on high voltage equipment.

Exercise care when servicing this chassis with power applied. Many B plus and high voltage RF terminals are exposed which, if carelessly contacted, can cause serious shock or result in damage to the chassis. Maintain interconnecting ground lead connections between chassis,escutcheon and picture tube dag cluster when operating chassis. The +B Adj.Control in this monitor is sealed in order to protect the user from X-ray irradiation.The +B Adj.Control should not normally have to be adjusted.But if it is,or if it is replaced due to damage,check the +B voltage to assure that it is within specifications after adjustment.Then seal this control according to the manufacture's specification.

Certain H V failures can increase X-ray radiation. Monitors should not be operated with H V levels exceeding the specified rating for the chassis type. The maximum operating H V specified for the chassis used in these monitor is 22 KV at zero beam current with a line voltage of 120V AC. Higher voltage may also increase possibility of failure in H V supply.

It is important to maintain specified values of all components in the horizontal and high voltage circuits and anywhere else in the monitor that could cause a rise in high voltage or operating supply voltage.No changes should be made to the original design of the monitor. Components shown in the shaded areas on the schematic diagram and/or identified by ⚠, ★ in the replacement parts list should be replaced only with exact Factory recommended replacement parts.

The use of unauthorized substitute parts may create a shock, fire,X-ray radiation,or other hazard.

To determine the presence of high voltage,use an accurate,high impedance,H Vmeter connected between the second anode lead and the CRT dag grounding device.When servicing the High Voltage System,remove static charge from it by connecting a 10K ohms resistor in series with an insulated wire (such as a test probe) between picture tube dag and 2nd anode lead. (AC line cord disconnected from AC supply.)

The picture tube used in this monitor employs integral implosion protection.Replace with a tube of the same type number for continued safety. Do not lift picture tube by the neck.Handle the picture tube only when wearing shatter-proof goggles and after discharging the high voltage completely.Keep others without shatter-proof goggles away.

When removing springs or spring mounting parts from the chassis,shatter-proof goggles must be worn.Keep others without shatter-proof goggles away.

• • • • • SAFETY INSPECTION • • • • •

Before returning the monitor to the user, perform the following safety checks:

• • • • • PROTECT YOUR CUSTOMER • • • • •

1.Inspect all lead dress to make certain that leads are not pinched and that hardware is not lodged between the chassis and other metal parts in the monitor.

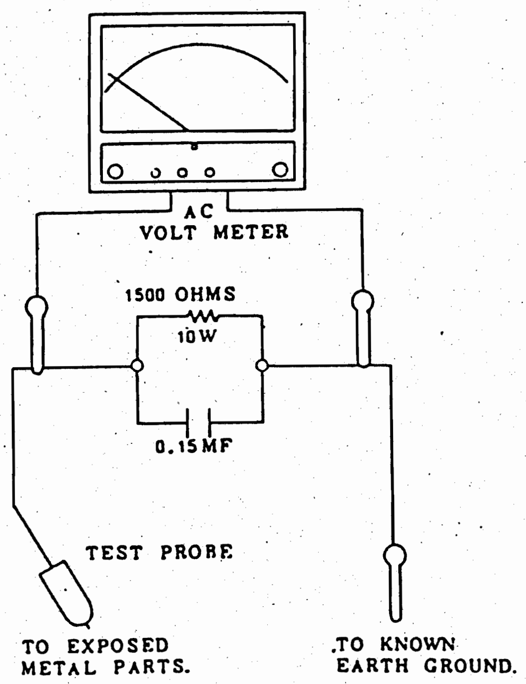
2.Replace all protective devices such as non-metallic control knobs,cabinet back, adjustment covers,shields,etc.

3.To be sure that no shock hazard exists, a check for the presence of leakage current should be made at each exposed metal part having a return path to the chassis(jack,cabinet metal, screw heads, knobs,shafts,etc.)in the following manner.

Plug the AC line cord directly into a 120V AC receptacle.(Do not use an Isolation Transformer during these checks.)All tests must be repeated with the AC line cord plug connections reversed.(If necessary,a non-polarized AC adapter plug must be used for the purpose of completing these checks.Do not otherwise operate the monitor with an adapter.)

If available,measure leakage current using an accurate leakage current tester.Any reading of 0.35MA or more is excessive and indicates a potential shock hazard which must be corrected before returning the monitor to the owner.

If a reliable leakage current tester is not available,this alternate method of measurement should be used.Using two clip leads,connect a 1500 ohms,10 watts resistor paralleled by a 0.15MF capacitor,in series with a known earth ground,such as a water pipe or conduit,and the metal part to be checked.Use a VTVM or VOM with 1000 ohms per volt,or higher,sensitivity to measure the AC voltage drop across the resistor. Any reading of 0.35 volt RMS or more is excessive and indicates a potential shock hazard.This must be corrected before returning the monitor to the owner.



IMPORTANT NOTICE FOR SERVICE PERSONNEL BEFORE SERVICING

PLEASE READ BEFORE ATTEMPTING SERVICE

1. While the monitor is in operation, do not attempt to connect or disconnect any wires.

2. Make sure the power cord is disconnected before replacing any components in the monitor.

3. When the power is on, do not attempt to short any portion of the circuit. This shorting may cause damage to the transistors in the monitor.

4. When servicing the H. V. area, be certain that the C. R. T anode is safely discharged to ground before removing the anode cap.

5. Caution must be exercised when servicing this monitor.
   The regulator has no current limiting and even a momentary short of an output voltage could cause destruction of the pass transistors.

Product Outline

This model is a 12-inch color display monitor used for a personal computer terminal. Its input is TTL separate signals. The input terminal is an 8-pin DIN jack.

Specifications

CRT	12-inch type with 646.8 mm R	
	• Facing: Non-glare face plate	630/640A, B, S
	Facing: Glare face plate	630/640U, J
	• Screen phosphor: 630/640	B22 (Short persistence)
Signal input	Separate R, G, B, I, H, V	
	• R, G, B, I: Positive	
	• Sync: Positive or negative	
Power Supply	Local commercial power supply	
Wattage	80 W	
Cabinet	Plastic	
Dimensions	322 (W) × 309 (H) × 372 (D) mm	
Weight	12 kg	
Scanning frequency	24.8 kHz (Horizontal)	
	54.3 Hz (Vertical)	

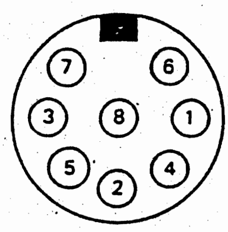
OPERATION

1. Plug the display and the computer into AC outlets.
2. Set the color mode switch on the rear panel.
3. Connect the signal input terminal on the rear panel to the computer using the optional cable.
4. Turn on display monitor and computer.
5. The green power indicator (just above the power switch) lights, then the CRT screen brightens. (There may be characters displayed.)
6. After the monitor warms up, set brightness and contrast if necessary.
7. Position of the image, image area, and focus are preset at the factory, so you don't have to adjust these. Depending on your computer, image width, height, and position may differ from the standard settings. In such a case, reset as necessary (controls are on the rear panel).

SIGNAL INPUT CONNECTORS

Signals are input through a DIN 8P connector. Each signal is assigned as following:

1. Pin assignment



[REAR VIEW]

2. Pin assignment

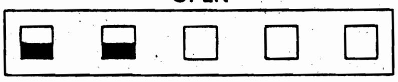
Pin no.	Signal
1	Reserved for special TEXT signal
2	Red video signal
3	Green video signal
4	Blue video signal
5	Intensity signal
6	Signal ground
7	Horizontal or composite sync signals
8	Vertical sync signal

HOW TO SET COLOR MODE

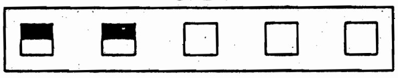
1. Setting the color mode

The color mode switch (a five-switch DIP unit) is on the rear panel. Set it as follows according to your computer.

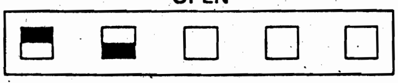
(1) Mode 1

Color mode switch	Color
OPEN  1 2 3 4 5	IBM

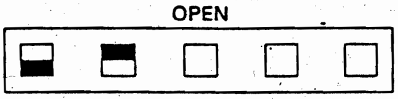
(2) Mode 2

Color mode switch	Color
OPEN  1 2 3 4 5	AT & T (OLIVETTI)*

(3) Mode 3

Color mode switch	Color
OPEN  1 2 3 4 5	APPLE

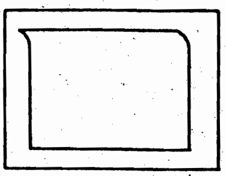
(4) Mode 4

Color mode switch	Color
OPEN  1 2 3 4 5	NTSC

*** Note – ADDENDUM for AT&T PC6300 and compatibles**

630/640 E, U, A, B, S are factory-set to use with IBM PC/XT/AT or compatibles. You may need the following adjustment in order to obtain maximum performance in display when you use with AT&T PC6300, PC6300 PLUS computer and compatibles.

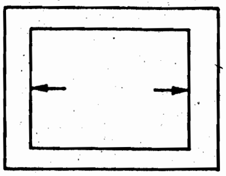
1. Curl at top



Turn H. HOLD counter-clockwise.
Turn H.POSI clockwise.

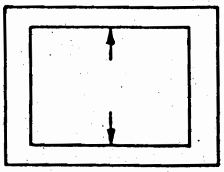
2. Small screen size

a) Horizontal size



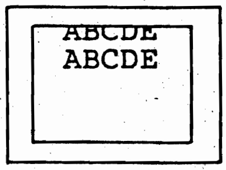
Turn H. SIZE counter-clockwise.

b) Vertical size



Turn V. SIZE counter-clockwise.

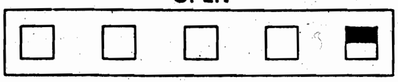
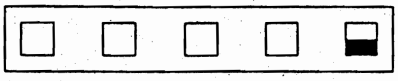
3. Characters missing at top



Turn V. HOLD clockwise.

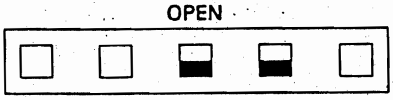
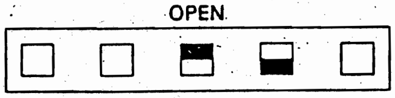
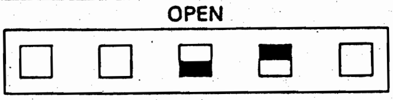
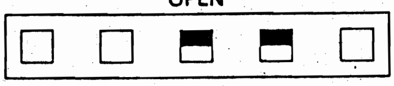
2. Setting the sync signal input mode (fifth color mode switch)

The sync signal of nearly any personal computer can be input by turning off the fifth DIP switch. But the sync signal of a few computers can be input only with this switch on. The following table shows the switch setting for a number of sync signals.

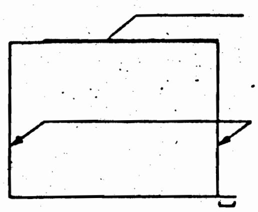
Color mode switch	Condition	Signal type
OPEN  1 2 3 4 5	A	H. sync: Positive TTL level V. sync: Negative TTL level
	B	H. sync: Negative TTL level V. sync: Positive TTL level
	C	H. V. sync composite, positive
OPEN  1 2 3 4 5	a	H. sync: Positive TTL level V. sync: Positive TTL level (AT&T)
	b	H. sync: Negative TTL level V. sync: Negative TTL level (IBM, JAPANESE)
	c	H. V. sync composite, negative

3. Setting the signal color display mode

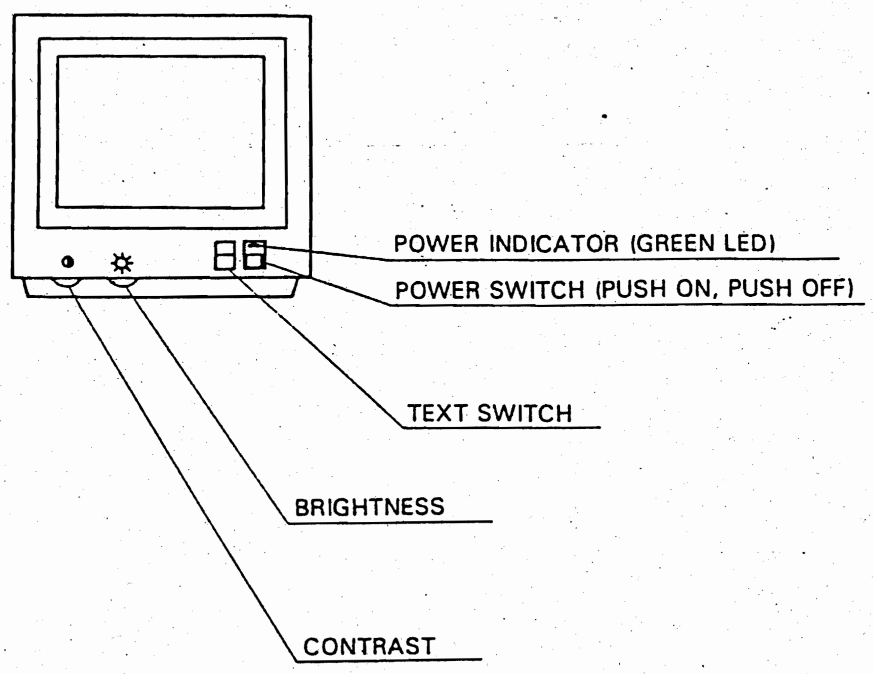
Turning of the TEXT switch (on the front of the unit) changes the display to single-color mode. Super Vision monitor can now be used as a monochrome display monitor. There are four basic monochrome modes: green, amber, reversed white, and white on blue. The monochrome mode is set by the third and fourth DIP switches as follows.

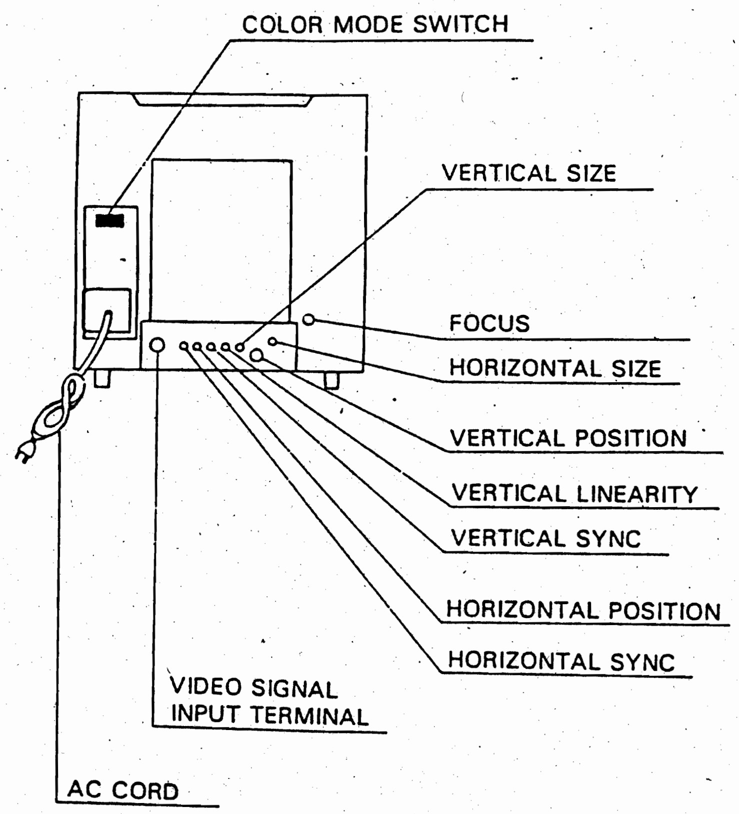
Color	Color mode switch
Green	OPEN  1 2 3 4 5
Amber	OPEN  1 2 3 4 5
** Reversed white	OPEN  1 2 3 4 5
** White on blue	OPEN  1 2 3 4 5

**Note: In reversed white or white on blue mode, the following phenomena may appear as described on the right.
These are quite normal for this mode.



INDICATORS AND CONTROLS





ADJUSTING THE DISPLAY

1. H. SIZE

If the horizontal size of the screen image is too short or too long, adjust the H. SIZE control for the correct size. (See illustration 1.)

2. V. SIZE

If the vertical size of the screen image is too short or too long, adjust the V. SIZE control for the correct size. (See illustration 2.)

3. H. POSI.

If the screen image shifts horizontally, adjust the H. POSI. control for a correct image. (See illustration 3.)

4. V. POSI.

If the screen image shifts vertically, adjust the V. POSI. control for a correct image. (See illustration 3.)

5. H. HOLD

If the screen image has horizontal stripes or if the image moves left or right, adjust the H. HOLD control for a clear stable image. (See illustration 4.)

6. V. HOLD

If the screen image moves or overlaps vertically, adjust the V. HOLD control for a stable image. (See illustration 4.)

7. FOCUS

Adjust the focus for the sharpest image. (See illustration 6.)

8. V. LIN.

Adjust the V. LIN control so the height of characters is even over the whole screen. (See illustration 7.)

9. CONTRAST

Turning the CONTRAST control clockwise increases the contrast, turning it counterclockwise decreases the contrast.

10. BRIGHT

Turning the BRIGHT control clockwise makes the screen brighter, turning it counterclockwise makes it darker.

11. SUB-CONTRAST

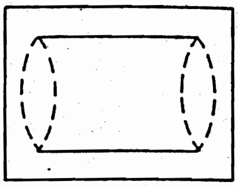
To adjust the subcontrast, display a screen of characters then turn the BRIGHT control to the click-stop position, and the CONTRAST control fully clockwise. Now adjust the SUB-CONTRAST control (VR140) to the position just before the characters become saturated.

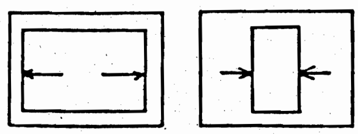
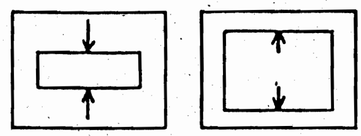
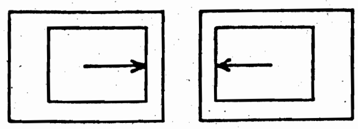
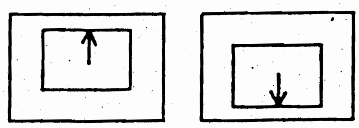
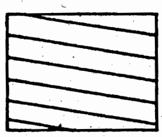
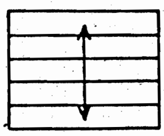
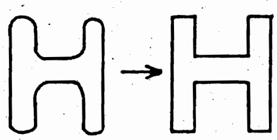
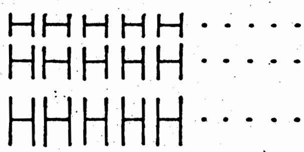
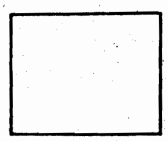
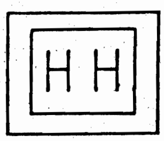
12. H. CENTER

To adjust horizontal centering turn the BRIGHT and the CONTRAST controls fully clockwise with nothing displayed on the screen. Then adjust the H. CENTER VR (R742) so that the raster is centered on the screen.

13. SIDE-PCC

Depending on computer models with which display monitors are connected, pincushion or barrel distortion appears on the right and left edge portions of their screen areas as shown in Fig. 1. The distortion on the right and left screen portions can be minimized by turning the "SIDE-PCC" potentiometer, clockwise or counter-clockwise, for optimum distortion-correction results.



	Problems		Adjustment
1	Width of the image is not correct.		H. SIZE Wide / Narrow
2	Height of the image is not correct.		V. SIZE Wide / Narrow
3	Position of the image is not correct.		H. POSITION Right / Left
			V. POSITION Up / Down
4	The image has a diagonal stripes.		H. HOLD
5	The image moves vertically (flops).		V. HOLD
6	The image is blurred.		FOCUS
7	Character heights on the screen are not uniform.		V. LIN
8	There is no image.		CONTRAST Bright / Dark
9	The screen is dark.		BRIGHT Bright / Dark

ALIGNMENT PROCEDURE

1 GENERAL ALIGNMENT

1.A PRELIMINARY ADJUSTMENT

1.A.1 Read and observe all safety precautions shown earlier in this manual.
1.A.2 Connect AC power and make sure that it is within the specified line voltage ± 2 V.
1.A.3 Allow the monitor to warm up for at least 30 minutes.
1.A.4 Roughly adjust the FOCUS control.
1.A.5 Connect a correctly adjusted color computer.

1.B Vcc ADJUSTMENT

1.B.1 Set the BRIGHT control fully clockwise.
1.B.2 Set the SCREEN control to its center position.
1.B.3 Set the H.HOLD control to the center of the range of picture stability.
1.B.4 Adjust VCC control VR920 to there is 115 ± 1.0 VDC between +B and chassis ground.

1.C HORIZONTAL AND VERTICAL ADJUSTMENT

1.C.1 Adjust L702 and VS701①(H. HOLD), and VS701②(H. POSI) for the best horizontal raster alignment.
1.C.2 Adjust VS701③(V. HOLD), VS701④(V. LIN), VS701⑤(V. SIZE), and VR628 (V. POSI.) for the best vertical raster alignment.

1.D FOCUS ADJUSTMENT

1.D.1 Display a full screen of characters.
1.D.2 Adjust the FOCUS control for the sharpest detail at the center of the screen.

1.E RGB CUTOFF WHITE BALANCE

1.E.1 Input a "black" signal to the monitor.
1.E.2 Set the RGB cutoff adjustment controls (VR801, 811, 821) at 3 o'clock.
1.E.3 Set the G, B drive controls (VR864, 865) to their center positions.
1.E.4 Adjust the SCREEN control to fully counterclockwise.
1.E.5 Set the BRIGHT control at the clik-stop position, CONTRAST control to Min., then turn on the service switch (S601).
1.E.6 Turn the screen adjustment control clockwise until a raster line appears.
1.E.7 Gradually turn the cutoff adjustment control counterclockwise except the one of the color that first appeared on the screen. Adjust them so that the raster lines of the three colors are the same intensity.
1.E.8 Turn off the service switch (S601), then input a "white" signal.
1.E.9 Set the BRIGHT control at the click-stop position, the CONTRAST control to Min., then adjust the cutoff adjustment controls of 1.E.7. so that the lowest luminescent white balance is 9300 kelvin.
1.E.10 Set the BRIGHT control at the click-stop position, the CONTRAST control to Max., then adjust the G, B dirve adjustment control so that the highest luminescent white balance is 9300 kelvin.
1.E.11 Set the BRIGHT control at the click-stop position, the CONTRAST control to Max., then check whether the lowest luminescent white is balanced. If not, repeat the steps from 1.E.9.

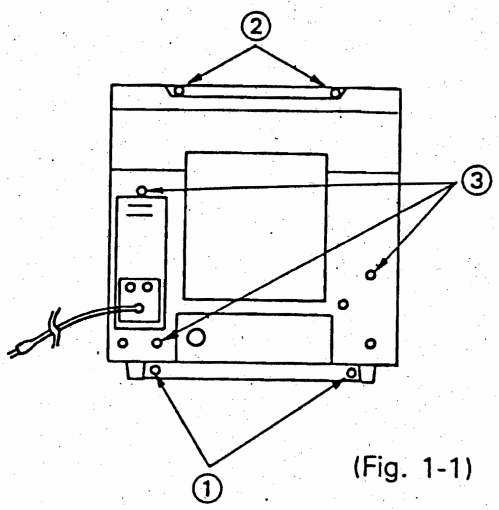
2 RASTER ALIGNMENT

2.A RASTER POSITION ADJUSTMENT

2.A.1 Input a white raster signal to the screen.
2.A.2 Set the raster size by alternately adjusting the HORIZONTAL and VERTICAL SIZE controls (L702 and VS701 ⑤), and VERTICAL LINEARITY controls (VS701 ④).
2.A.3 Center the raster by alternately adjusting the HORIZONTAL POSITION and VERTICAL POSITION controls (VS701 ② and VR628).

DISASSEMBLY PROCEDURE

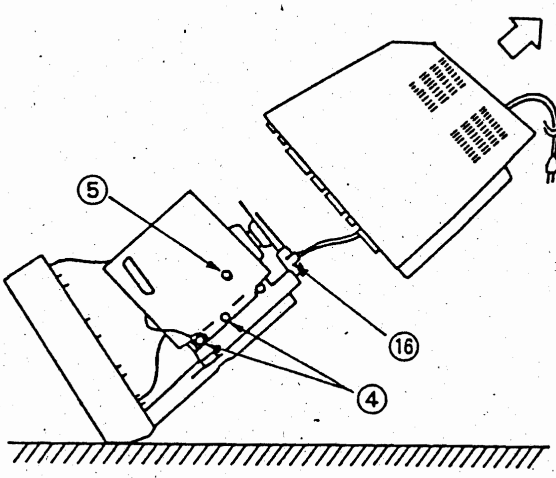
The following pictures show the basis chassis. Individual products may be different in details.



(Fig. 1-1)

1. REMOVING THE BACK COVER
(1) Unplug the unit from the wall outlet.
(2) Remove the two screws ① from the bottom, the two screws ② from the top, and the three screws ③ from the rear of the set. (Fig. 1-1)
(3) Remove back cover.
(4) Re-assemble in reverse order.

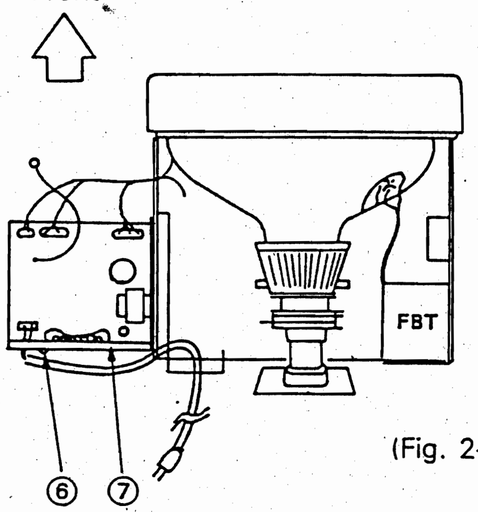
NOTE: Tilting the front block by 45° helps when re-assembling back cover. (Fig. 1-2)



(Fig. 1-2)

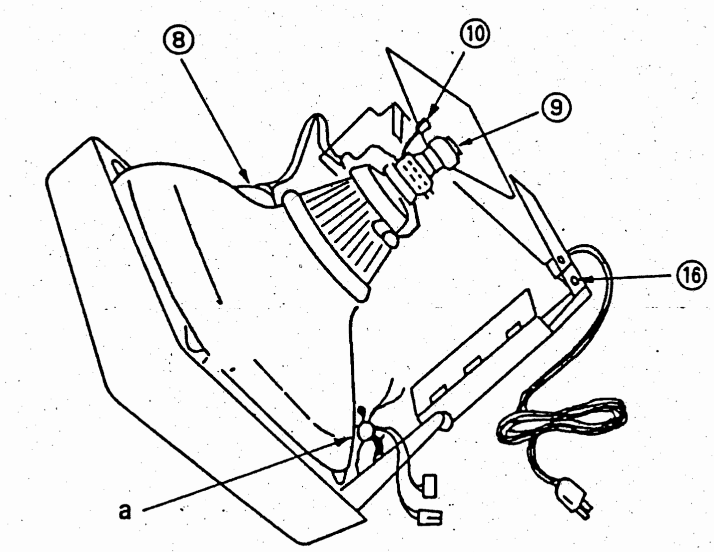
2. SERVICING THE POWER SUPPLY BLOCK
(1) Remove the screw ④. (Fig. 1-2)
(2) Disconnect power supply connectors I, II, III, IV. (Fig. 2-1)

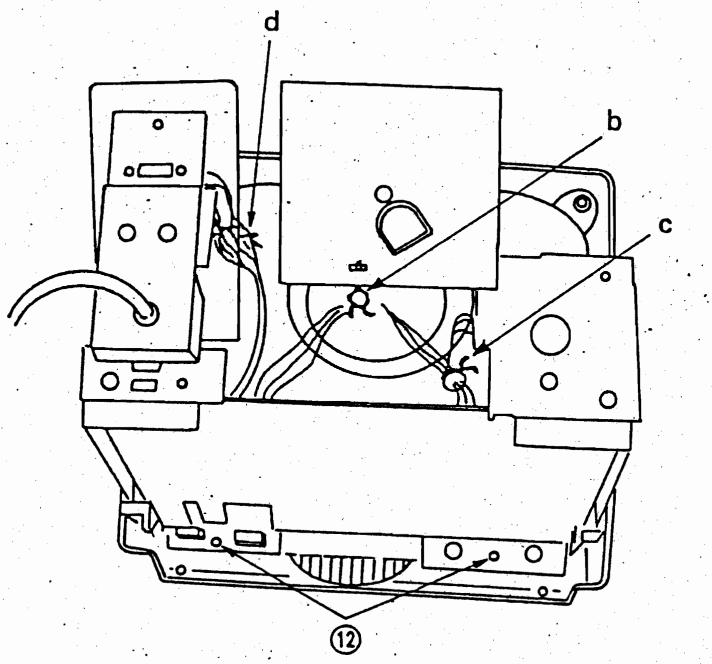
NOTE: Connector names are as follows:
- I) A.C. Power Cord Connector.
- II) Power Switch Connector
- III) Auto Degaussing Connector.
- IV) B Connector

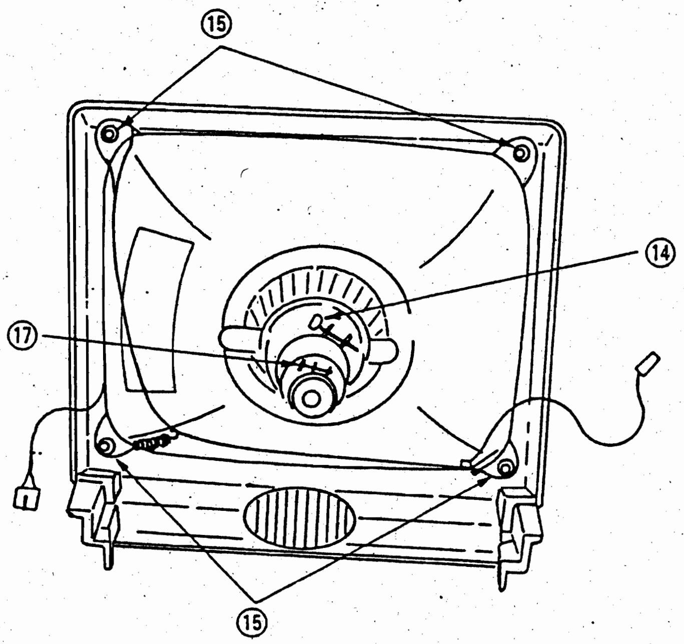


(Fig. 2-1)

(3) Remove the screw ⑥ and take off the I. C. holding metal plate ⑦. (Fig. 2-1)
(4) Remove the screw ⑤ and slide the power supply PWB to the front. (Fig. 1-2, Fig. 2-1)
(5) Reassemble in reverse order.







3. PWB MAIN SERVICE

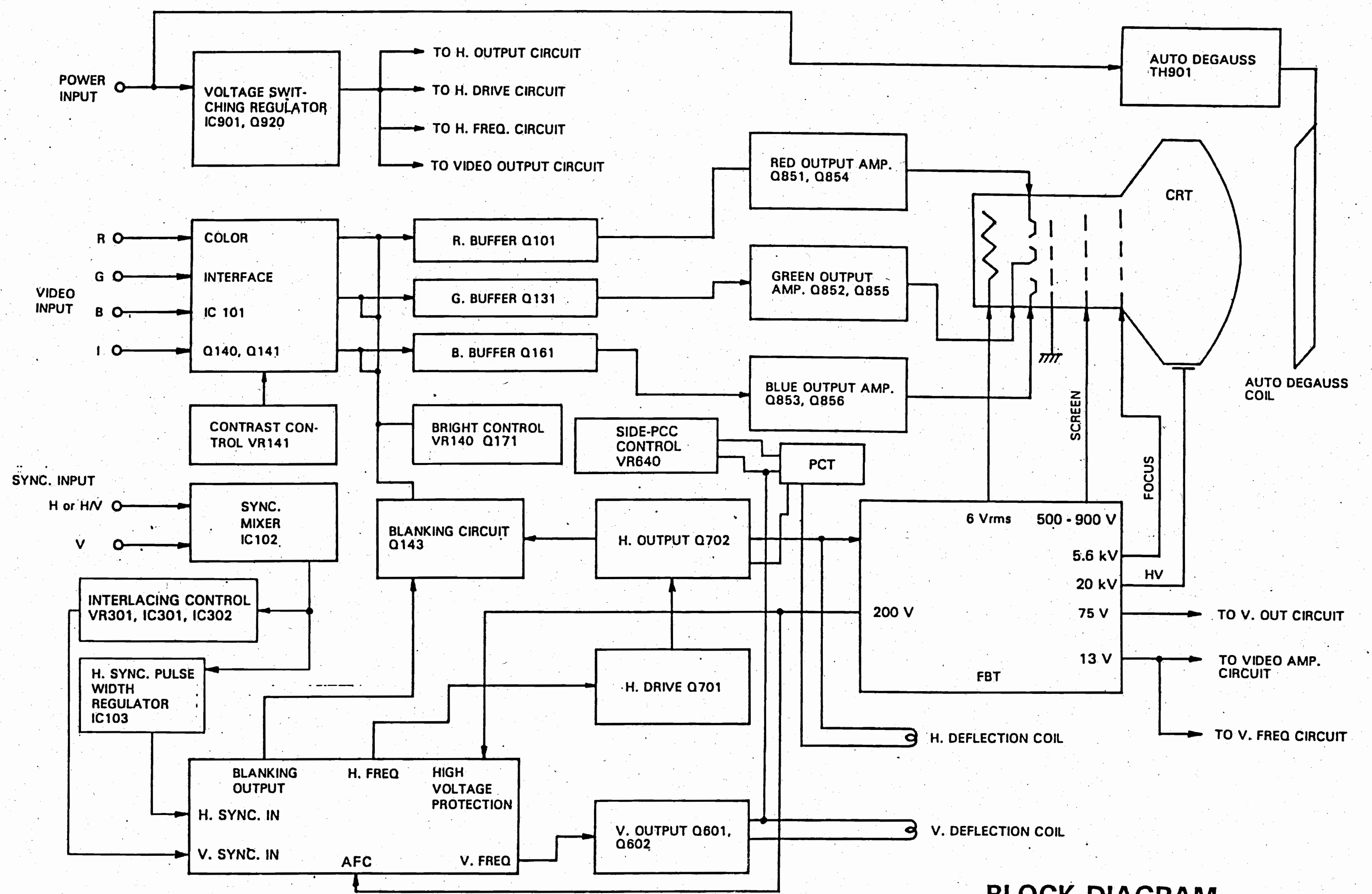
After removing the back cover, follow this procedure (Fig. 2-1) to allow easy access to the main PWB.

(1) Disconnect CRT anode lead⑧, CRT Socket⑨, Connector coating earth ⑩ , and connector D.Y. (Fig. 3-1)
(2) Remove the two screws ⑫, ⑯ .(Fig. 3-2, Fig. 1-2)
(3) Take off the lead clamp (a, b, c, d). (Fig. 3-1, Fig. 3-2)
(4) PWB holder (R.L.) will open both side and pull out the main PWB. (Fig. 3-2)
(5) Re-assemble in reverse order.

4. PICTURE TUBE REMOVAL

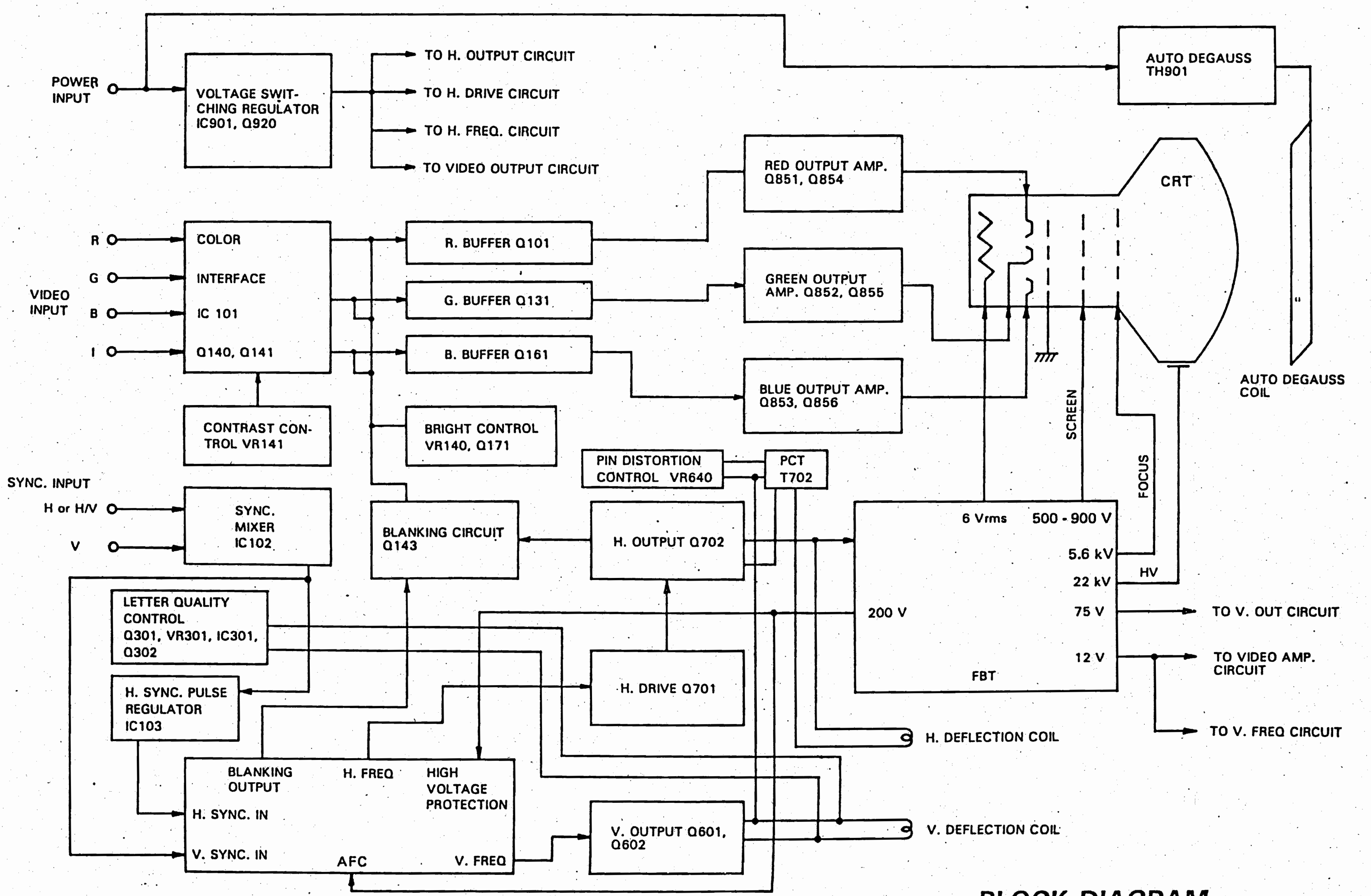
The main PWB must be removed before attempting to remove the picture tube.

(1) Loosen the screw ⑬ and remove the convergence magnet assembly. (Fig. 4-1)
(2) Loosen the screws ⑭, ⑰ and remove the Deflection Yoke. (Fig. 4-1)
(3) Remove the four screws ⑮ at the corners of the picture tube and carefully remove the tube. (Fig. 4-1)
(4) Re-assemble in reverse order.



BLOCK DIAGRAM

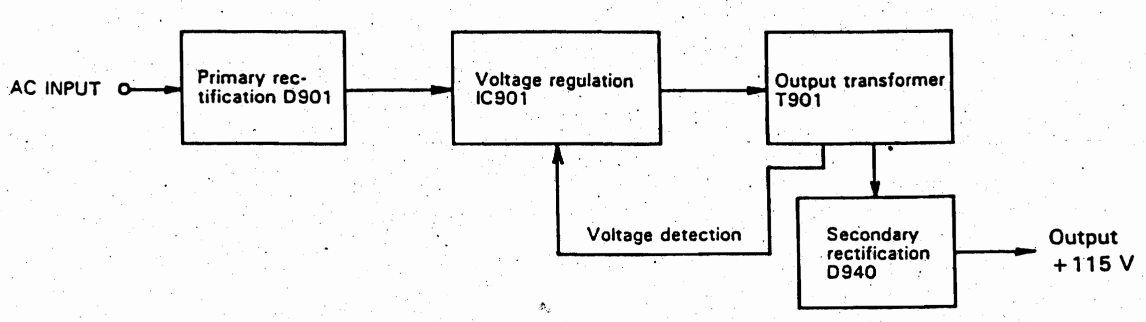
[Version I]



BLOCK DIAGRAM
[Version II]

1. Operation Principles

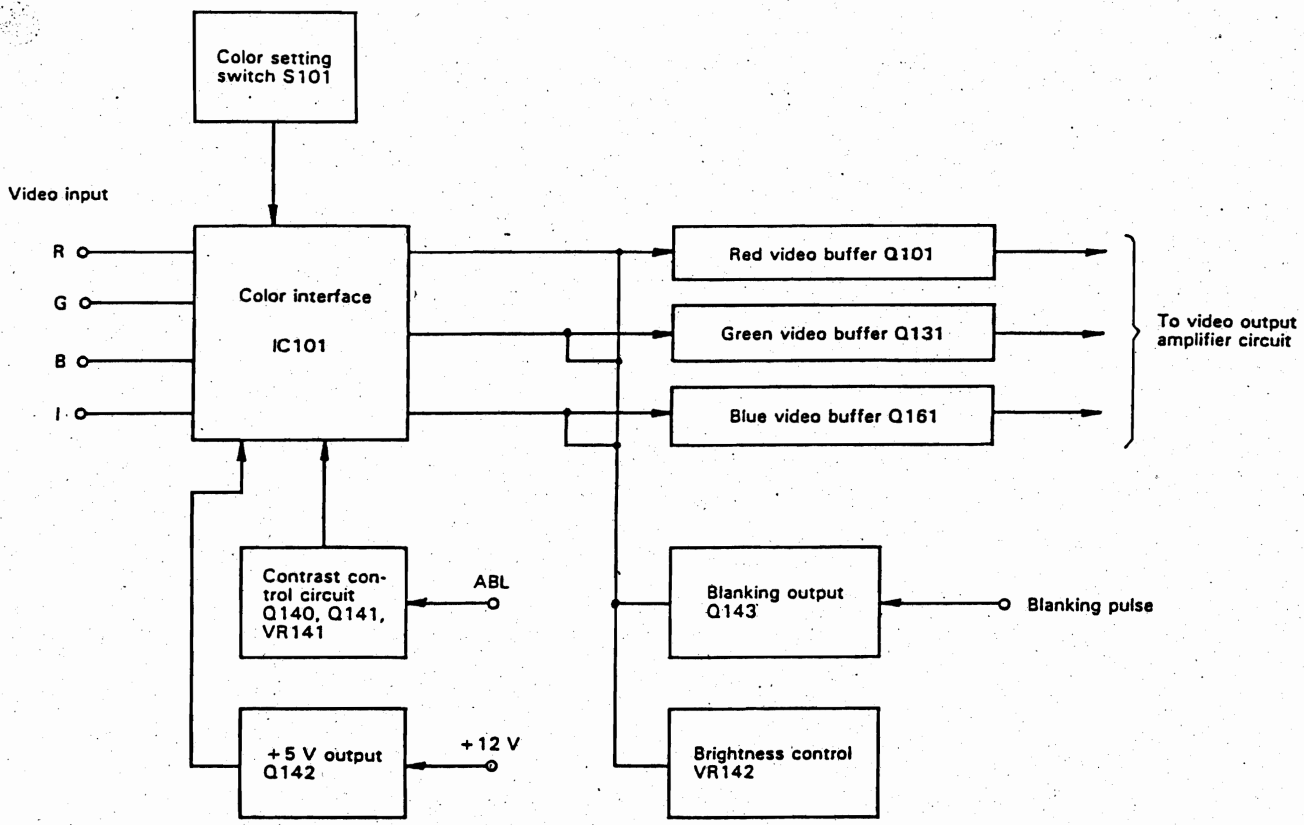
1-1 Voltage regulator circuit



The voltage regulator circuit of this unit uses a switching regulator system. In other words, the input AC supply voltage is rectified to unfiltered DC voltage by the primary rectifier circuit. This voltage is converted to high-frequency pulses by the voltage regulator IC (IC901) which simultaneously performs pulse width control for regulation of a secondary rectification output. The DC output with no ripple (+115V) is obtained by the secondary rectifier D940 following the passage through the output transformer T901. This IC has a built-in overcurrent protection circuit.

1-2 Video circuit

(1) Color interface circuit

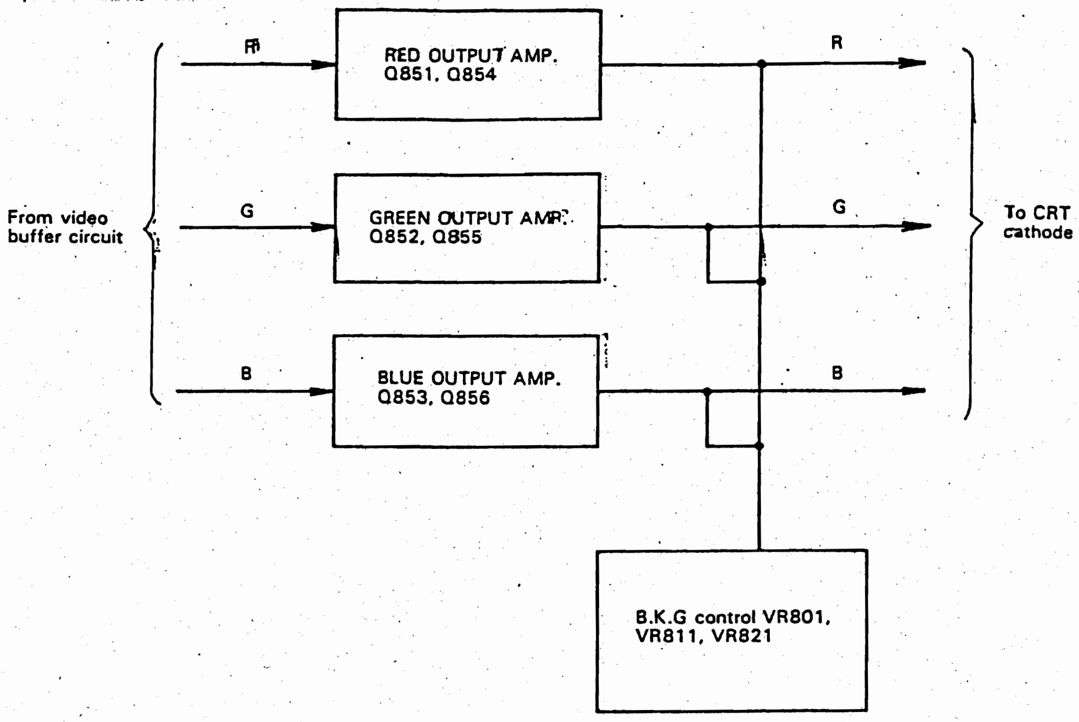


The input video signals R, G, B, I are combined by IC101 into optional colors (e.g. IBM colors, Apple colors, standard colors) set up by the color setting switch S101 and sent to the respective video buffers (Q101, Q131, Q161). The output voltage level of the color interface IC101

can be controlled by the contrast circuit of Q140, Q141, VR141, which permits screen brightness control. The contrast circuit also has an ABL circuit attachment which prevents the CRT beam current from increasing abnormally when trouble occurs.

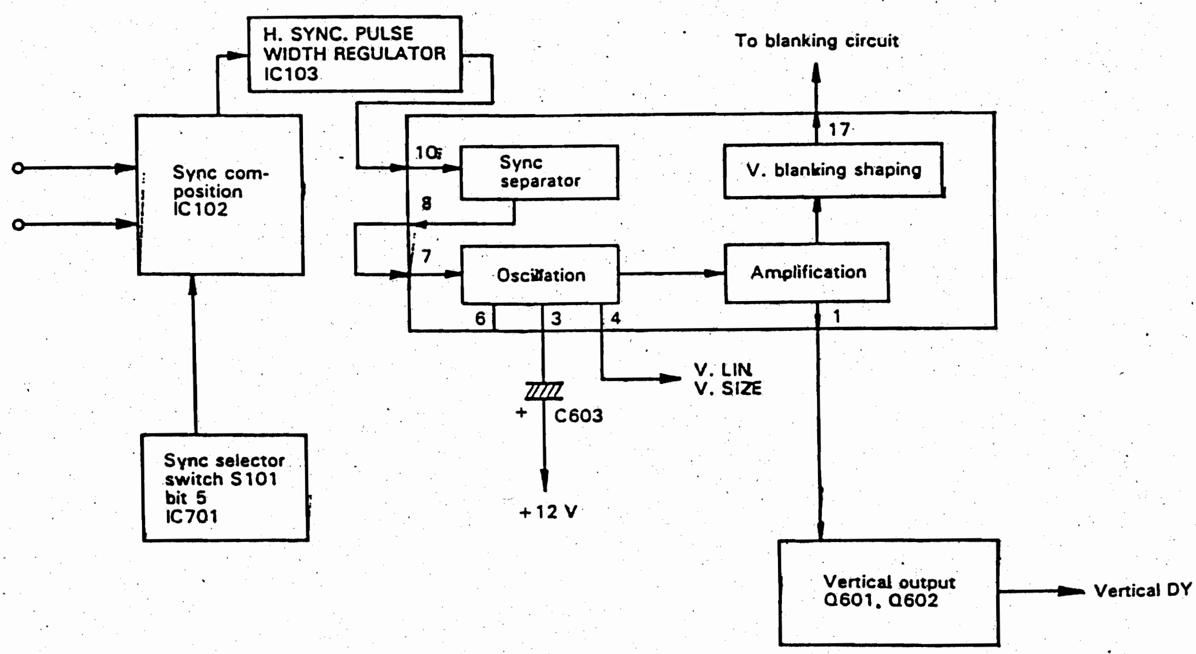
The blanking circuit Q143 and brightness control VR142 connected between the color interface and video buffers are used for blanking and black level control.

(2) Video amplifier circuits

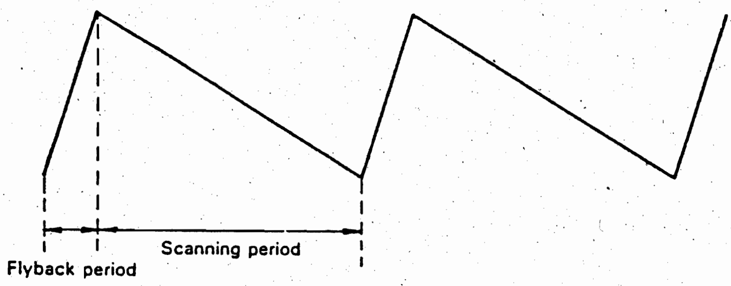


The R, G, B, video signals composed by the color interface circuit pass through the video buffer circuits and are entered in the respsctive R, G, B video output amplifiers where they are amplified to about 50 Vp-p for output to the CRT cathode. The background (B.K.G.) control resister VR801 (red), VR811 (green), VR821 (blue) which serve to fix the CRT cutoff level are connected between the video output amplifiers and the CRT cathode.

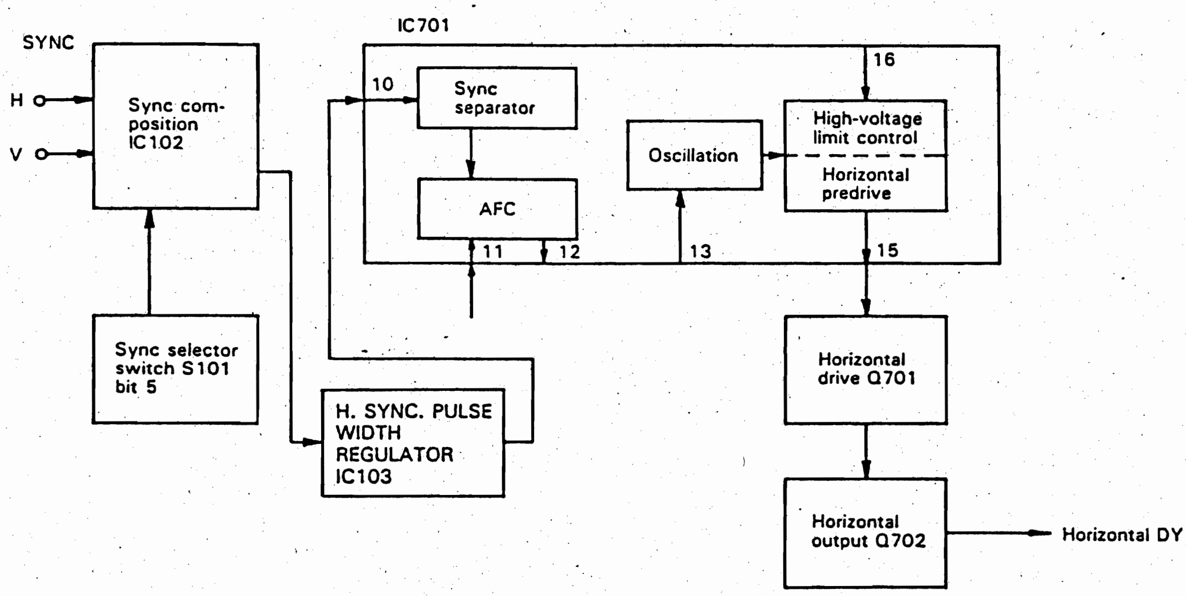
1-3 Vertical deflection circuit



The sawtooth oscillating voltage is generated by the charge and discharge of C603. During a vertical flyback period, C603 is charged from pin ③ of the IC701 by the switching transistor inside the IC. During a scanning period, it is discharged by the resistor R602 and the vertical linearlity control VS701 ④ connected to pin ④ of the IC. As a result, the potential slowly decreases. When this potential reaches the same level as that applied to pin ⑦ of the IC, the charging starts again by the switching transistor in the IC, corresponding to the flyback period. Meanwhile, the output voltage applied to the deflection yoke is amplified by the amplifier circuit inside the IC and applied to the vertical output transistor Q601, Q602 from pin ① of the IC. These transistors drive the vertical DY.



1-4 Horizontal deflection circuit



(1) AFC circuit

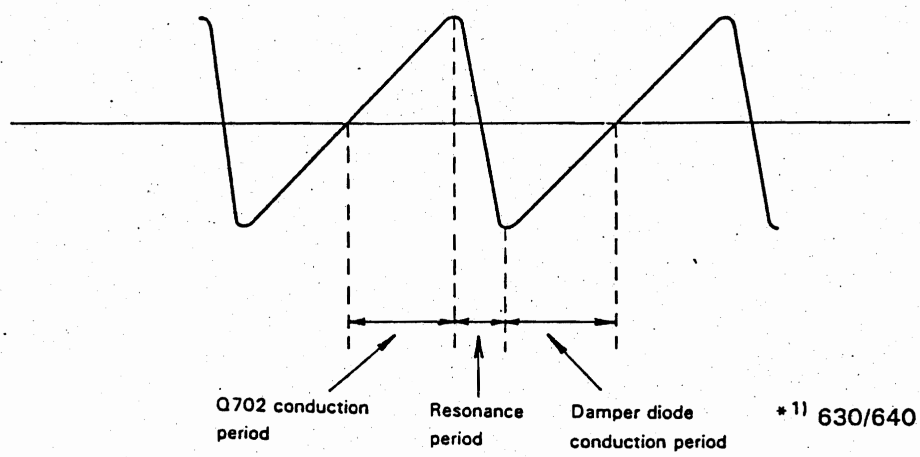
The triangular voltage generated from the flyback transformer pulses is applied to pin ⑪ of the IC701 and the sync signal is applied directly to the AFC circuit from the sync separator circuit inside the IC. The AFC circuit compares the phase between these signals and outputs from pin ⑫ of the IC the current proportional to the phase difference. This current is sent from pin ⑬ of the IC via the resistor R702 to the horizontal oscillator circuit for oscillating frequency control.

(2) Oscillator circuit

A triangular oscillating voltage is generated by the capacitors C703, C732. C703 and C732 are charged via the resistors R703, R704 and the H. HOLD control VS701 ① and discharged by the internal circuit of the IC.
From this triangular wave is created a rectangular wave with a duty ratio of 1 to 2 which is output from the pin ⑮ of the IC.

(3) Horizontal drive, horizontal ouput circuit

Since an approximate 400 mAp-p must flow in the base of the horizontal output transistor Q702, the oscillating voltage is amlified by the drive circuit composed of Q701 and T701. Consequently, a linearly increasing current flows in the coil. When Q702 is non-conducting, the current previously flowing in Q702 comes to flow in C717, C718, C719 for resonance with these capacitors and the coil.
At half of the resonance cycle, the current direction is reversed and the current now flows through the damper diode (inside Q702)*[1]. By making Q702 conducting again while the current flows in this diode, a periodic sawtooth current is allowed to flow in the horizontal coil.



*1) 630/640 E, A, B, J, S

An approximate 1kVp-p pulse voltage generated by resonance of the capacitors and coil is boosted by T703 (FBT) and supplied to each CRT electrode, the vertical output circuit, video circuit, etc.

(4) High-voltage limit control circuit

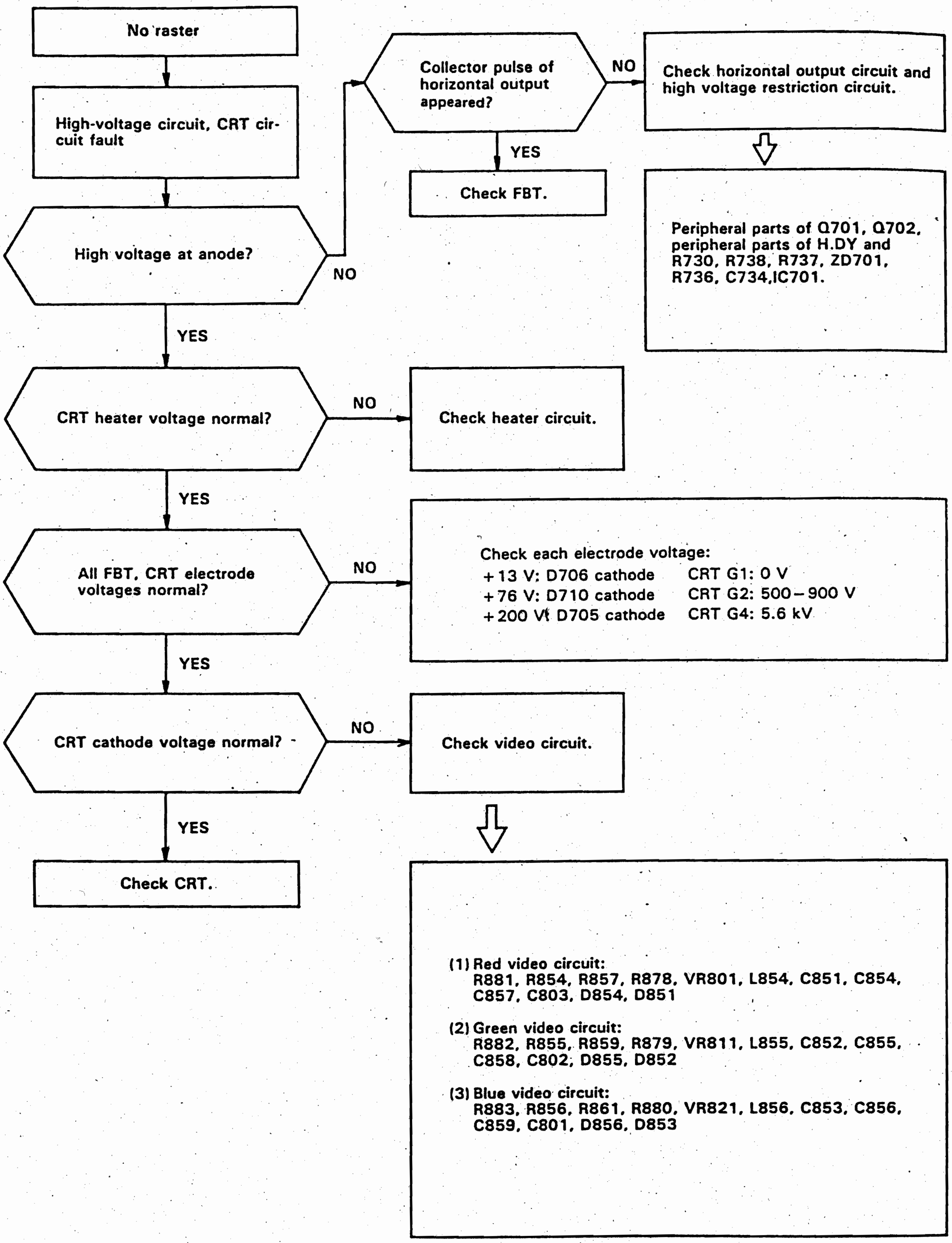
If a high voltage applied to CRT from T703 (FBT) rises abnormally for some reason and exceeds approximately 28 kV, the high-voltage detector voltage output from pin ⑦ of T703 (FBT) is applied to pin ⑯ of IC701, which stops the output of the horizontal predrive inside the IC701.

2. Repair Chart

Turn on power and connect the input signals.

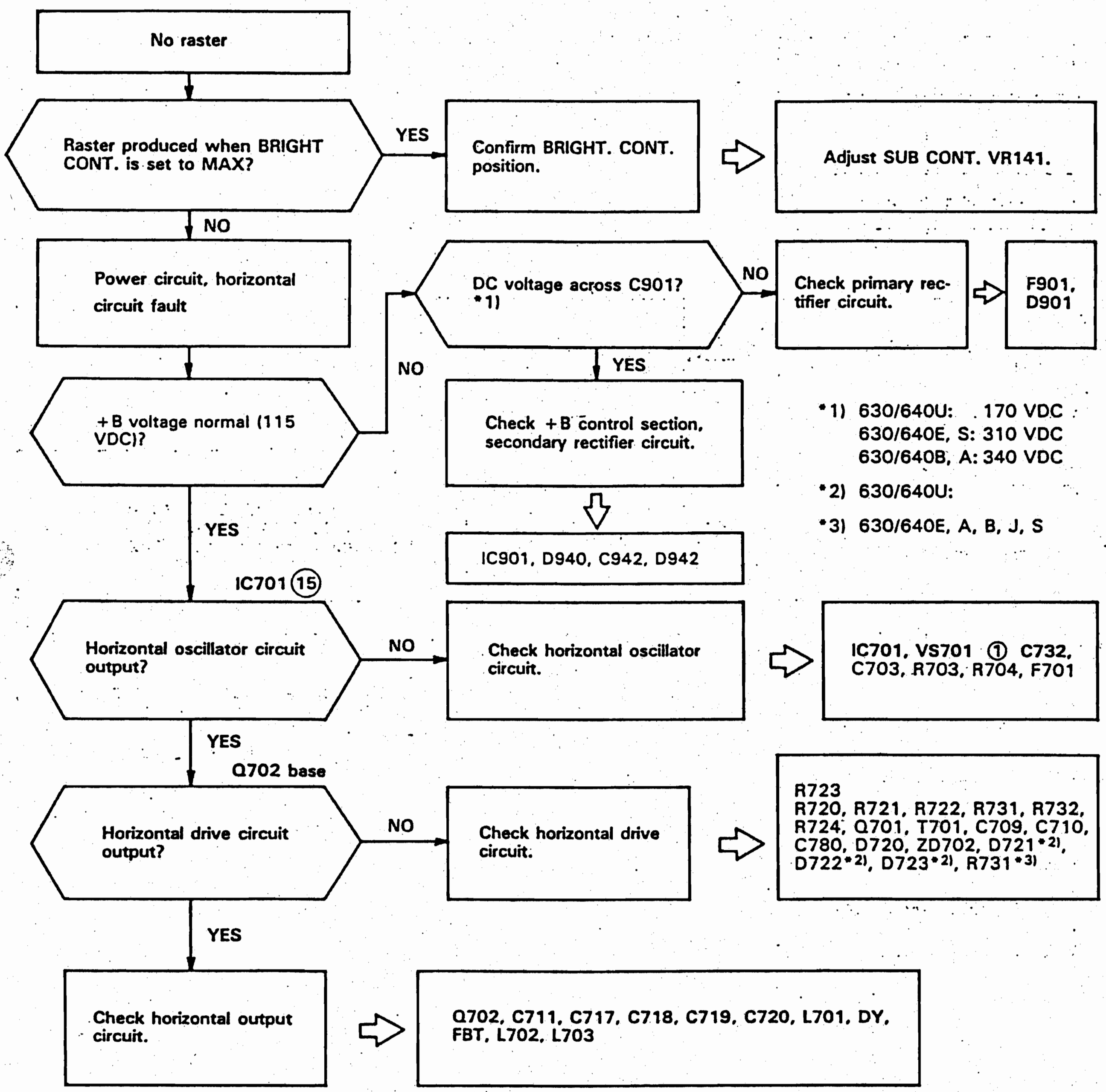
- **No raster**
  - Faulty input voltage — (check +B line, horizontal output circuit)
  - **Normal input voltage** — (check horizontal circuit, CRT circuit)
    - Only a horizontal line — (vertical circuit)
    - Only a vertical line — (DY circuit)
- **The raster appears.**
  - No picture — (check +12 V, +5 V line, video circuit)
  - **The picture appears.**
    - Horizontal amplitude too small — (horizontal circuit)
    - Abnormal vertical amplitude — (vertical circuit)
    - Dark screen — (CRT peripheral circuit, video circuit)
    - No horizontal synchronization — (AFC, horizontal oscillator circuit)
    - No vertical synchronization — (vertical circuit)
    - Abnormal hue — (color interface circuit, video circuit)
    - Different luminance between horizontal and vertical dots of a character — (video circuit)
    - Bad focus — (CRT peripheral circuit)
    - Bad side distortion — (Side-PCC circuit)

No raster (2): Troubles in the FBT peripheral circuit

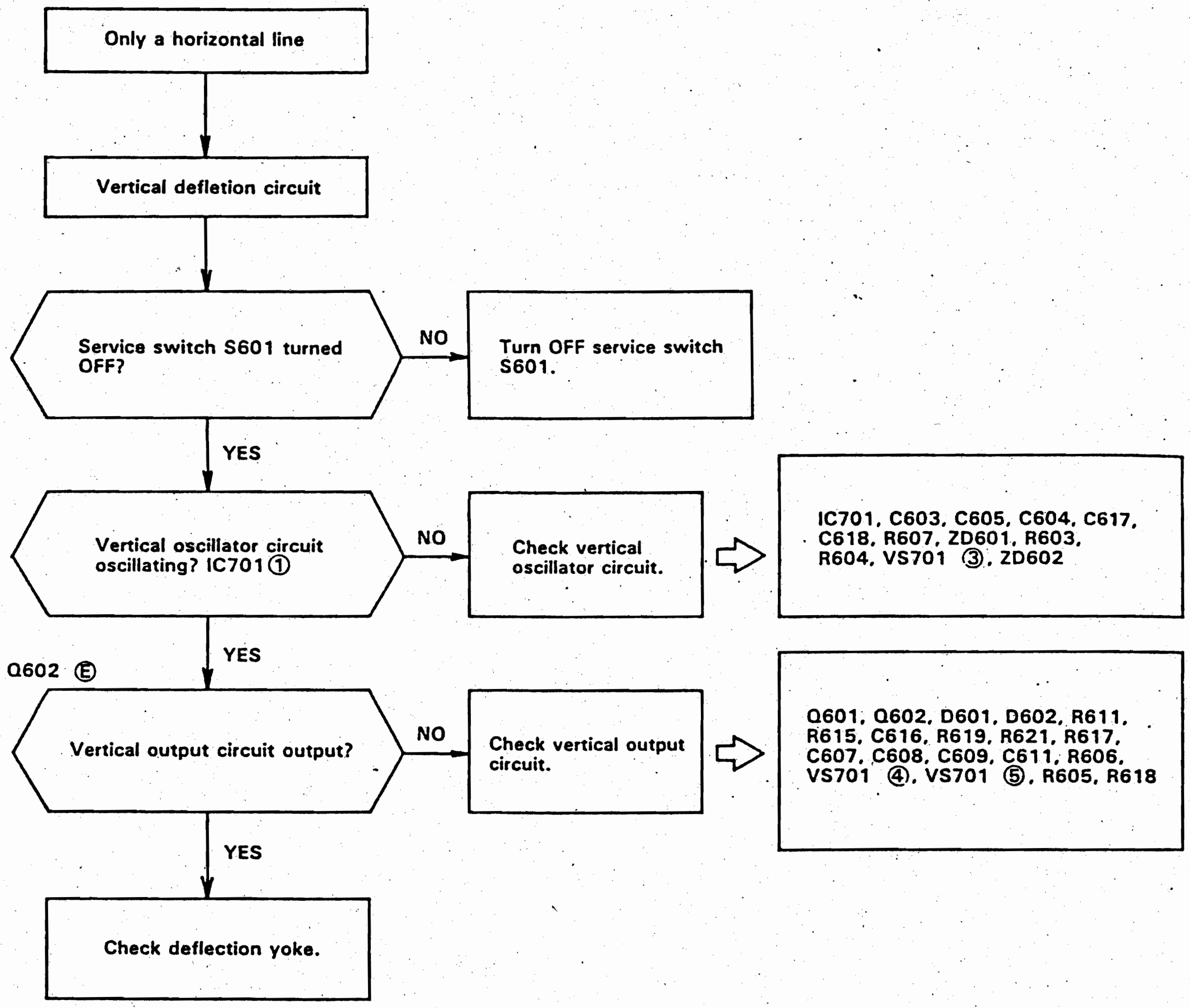


3. Troubleshooting

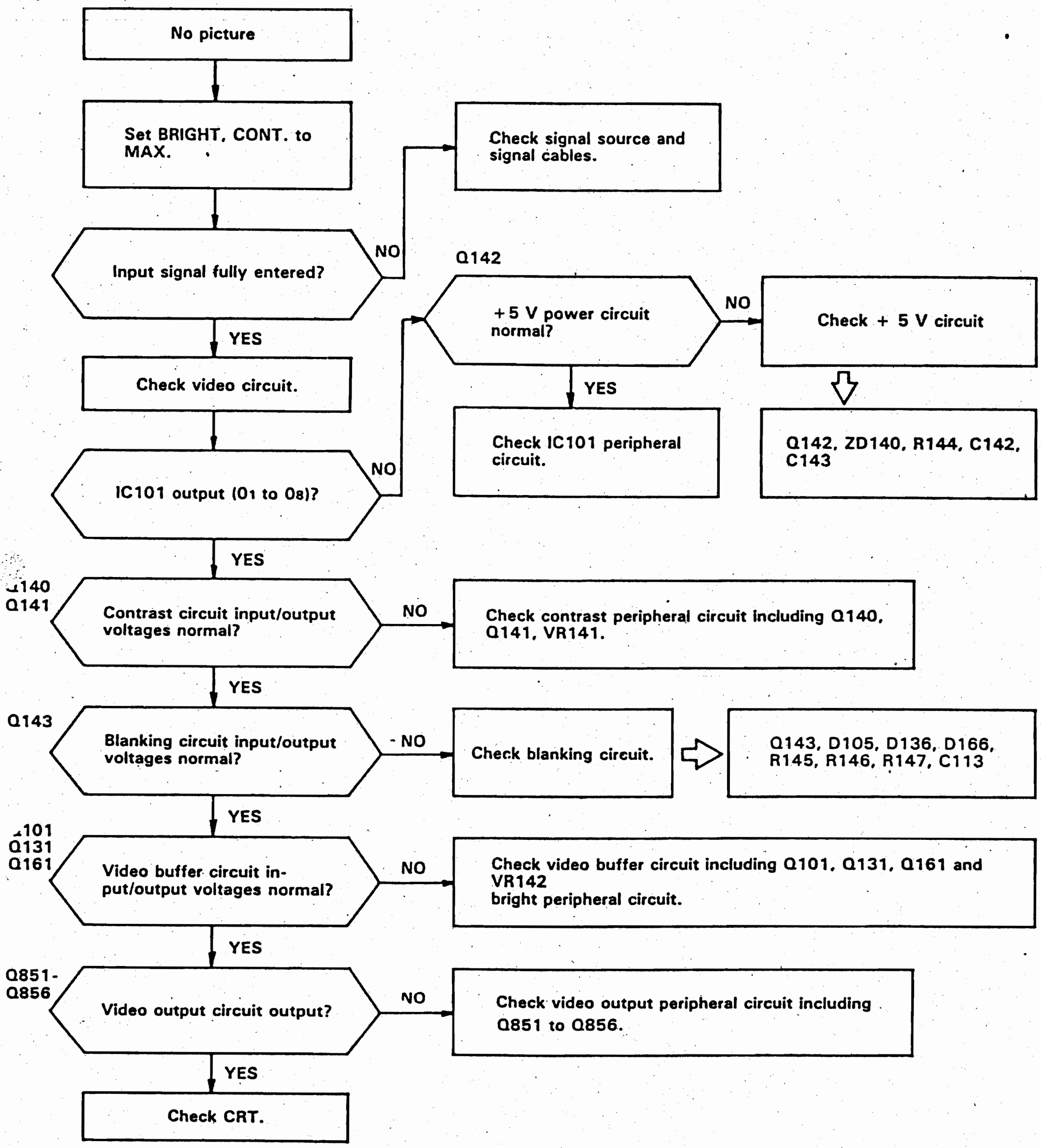
No raster (1): Troubles in the power circuit, horizontal deflection circuit



Only a horizontal line



No picture



No picture
Set BRIGHT, CONT. to MAX.
Input signal fully entered?
NO
Check signal source and signal cables.
YES
Check video circuit.
Q142
+5 V power circuit normal?
NO
Check + 5 V circuit
Q142, ZD140, R144, C142, C143
YES
Check IC101 peripheral circuit.
IC101 output (O1 to O8)?
NO
YES
140
Q141
Contrast circuit input/output voltages normal?
NO
Check contrast peripheral circuit including Q140, Q141, VR141.
YES
Q143
Blanking circuit input/output voltages normal?
NO
Check blanking circuit.
Q143, D105, D136, D166, R145, R146, R147, C113
YES
101
Q131
Q161
Video buffer circuit input/output voltages normal?
NO
Check video buffer circuit including Q101, Q131, Q161 and VR142
bright peripheral circuit.
YES
Q851-
Q856
Video output circuit output?
NO
Check video output peripheral circuit including Q851 to Q856.
YES
Check CRT.

PARTS LIST

•: for Version 1 /*: for Version 2

No.	Component	Symbol no.	Ratings			Parts no.	Remarks
1	Resistor	R723, R731	3.9 ohm,	1/8 W,	Carbon film	0100007	
2	Resistor	R640	18 ohm,	1/8 W,	Carbon film	01000023G	
3	Resistor	R641	22 ohm,	1/8 W,	Carbon film	01000025G	
4	Resistor	R721, R884, R886	47 ohm,	1/8 W,	Carbon film	01000033	
	Resistor	R887, R888	47 ohm,	1/8 W,	Carbon film	01000033	
5	Resistor	R885	56 ohm,	1/8 W,	Carbon film	01000035	
6	Resistor	R173, R175, R177	68 ohm,	1/8 W,	Carbon film	01000037	
7	Resistor	R103, R113, R114	100 ohm,	1/8 W,	Carbon film	01000041	
	Resistor	R133, R163, R173	100 ohm,	1/8 W,	Carbon film	01000041	
	Resistor	R611, R732, R872	100 ohm,	1/8 W,	Carbon film	01000041	
	Resistor	R873, R874, R801	100 ohm,	1/8 W,	Carbon film	01000041	
	Resistor	R811, R821	100 ohm,	1/8 W,	Carbon film	01000041	
8	Resistor	R606	180 ohm,	1/8 W,	Carbon film	01000047	
9	Resistor	R752, R140	270 ohm,	1/8 W,	Carbon film	01000051	
	Resistor	R149	270 ohm,	1/8 W,	Carbon film	01000051F	
	Resistor	R302•, R309•	270 ohm,	1/8 W,	Carbon film	01000053G	
	Resistor	R104, R171, R105	270 ohm,	1/8 W,	Carbon film	01000053	
	Resistor	R134, R135, R136	270 ohm,	1/8 W,	Carbon film	01000053	
	Resistor	R164, R165, R166	270 ohm,	1/8 W,	Carbon film	01000053	
	Resistor	R174, R176, R178	270 ohm,	1/8 W,	Carbon film	01000053	
10	Resistor	R180, R183, R184	390 ohm,	1/8 W,	Carbon film	01000055	
	Resistor	R185	390 ohm,	1/8 W,	Carbon film	01000055	
11	Resistor	R107, R139, R124	470 ohm,	1/8 W,	Carbon film	01000057	
	Resistor	R169, R172, R609	470 ohm,	1/8 W,	Carbon film	01000057	
	Resistor	R304•, R305•	470 ohm,	1/8 W,	Carbon film	01000057G	
12	Resistor	R154, R156, R158	680 ohm,	1/8 W,	Carbon film	01000061	
13	Resistor	R108, R727	820 ohm,	1/8 W,	Carbon film	01000063	
14	Resistor	R302*	1k ohm,	1/8 W,	Carbon film	01000065F	
	Resistor	R106, R138, R142	1k ohm,	1/8 W,	Carbon film	01000065	
	Resistor	R143, R144, R153	1k ohm,	1/8 W,	Carbon film	01000065	
	Resistor	R155, R157, R168	1k ohm,	1/8 W,	Carbon film	01000065	
	Resistor	R619, R625, R707	1k ohm,	1/8 W,	Carbon film	01000065	
15	Resistor	R305*	1.5k ohm,	1/8 W,	Carbon film	01000069G	
16	Resistor	R736	1.8k ohm,	1/8 W,	Carbon film	01000071G	
17	Resistor	R137, R167, R753	2k ohm,	1/8 W,	Carbon film	01000072	
	Resistor	R753	2k ohm,	1/8 W,	Carbon film	01000072G	
18	Resistor	R147, R605, R704	2.2k ohm,	1/8 W,	Carbon film	01000073	
	Resistor	R102, R132, R162	2.2k ohm,	1/8 W,	Carbon film	01000073	
	Resistor	R192	2.2k ohm,	1/8 W,	Carbon film	01000073	
	Resistor	R308•, R303•, R306	2,2k ohm,	1/8 W,	Carbon film	01000073G	
19	Resistor	R101, R131, R161	3.3k ohm,	1/8 W,	Carbon film	01000077	
	Resistor	R191	3.3k ohm,	1/8 W,	Carbon film	01000077	
20	Resistor	R604	4.3k ohm,	1/8 W,	Carbon film	01000080	
21	Resistor	R120	4.7k ohm,	1/8 W,	Carbon film	01000081F	
	Resistor	R111, R112	4.7k ohm,	1/8 W,	Carbon film	01000081	
	Resistor	R119, R121, R123	4.7k ohm,	1/8 W,	Carbon film	01000081	
	Resistor	R708, R608	4.7k ohm,	1/8 W,	Carbon film	01000081	
22	Resistor	R754	5.1k ohm,	1/8 W,	Carbon film	01000082	
	Resistor	R931	5.1k ohm,	1/8 W,	Carbon film	01000082G	
23	Resistor	R715, R622	5.6k ohm,	1/8 W,	Carbon film	01000083G	
24	Resistor	R703	6.8k ohm,	1/8 W,	Carbon film	01000085	
25	Resistor	R612	8.2k ohm,	1/8 W,	Carbon film	01000087	

PARTS LIST

: for Version 1 /: for Version 2

No.	Component	Symbol no.	Ratings			Parts no.	Remarks
26	Resistor	R145, R146, R711	10k ohm,	1/8 W,	Carbon film	01000089	
	Resistor	R308*	10k ohm,	1/8 W,	Carbon film	01000089G	
27	Resistor	R603, R929	13k ohm,	1/8 W,	Carbon film	01000092	
28	Resistor	R301*	15k ohm,	1/8 W,	Carbon film	F020084T	
	Resistor	R737	15k ohm,	1/8 W,	Carbon film	01000093G	
29	Resistor	R607	18k ohm,	1/8 W,	Carbon film	01000095G	
30	Resistor	R602	22k ohm,	1/8 W,	Carbon film	01000097	
	Resistor	R935	22k ohm,	1/8 W,	Carbon film	01000097G	
31	Resistor	R706	33k ohm,	1/8 W,	Carbon film	01000101	
32	Resistor	R115	75k ohm,	1/8 W,	Carbon film	01000110	
33	Resistor	R725	150k ohm,	1/8 W,	Carbon film	01000117G	
34	Resistor	R857, R859, R861	180k ohm,	1/8 W,	Carbon film	01000119G	
	Resistor	R878, R879, R880	180k ohm,	1/8 W,	Carbon film	01000119G	
35	Resistor	R726	270k ohm,	1/8 W,	Carbon film	01000117	
36	Resistor	R930	4.7 ohm,	1/4 W,	Carbon film	0114009T	
37	Resistor	R610	8.2 ohm,	1/4 W,	Carbon film	0114015	
38	Resistor	R860, R862	100 ohm,	1/4 W,	Carbon film	0114131T	
39	Resistor	R129	680 ohm,	1/4 W,	Carbon film	0114151	
40	Resistor	R928	1k ohm,	1/4 W,	Carbon film	0114161T	
41	Resistor	R881	1.8k ohm,	1/4 W,	Carbon film	0114167T	
42	Resistor	R883	2.2k ohm,	1/4 W,	Carbon film	0114169T	
43	Resistor	R882	2.7k ohm,	1/4 W,	Carbon film	0114171T	
44	Resistor	R722	3.3k ohm,	1/4 W,	Carbon film	0114173	
45	Resistor	R921	3.9k ohm,	1/4 W,	Carbon film	0114175T	
46	Resistor	R728	6.8k ohm,	1/4 W,	Carbon film	0114181T	
	Resistor	R734	6.8k ohm,	1/4 W,	Carbon film	0114181	
47	Resistor	R738	30k ohm,	1/4 W,	Carbon film	0114212	
48	Resistor	R730	39k ohm,	1/4 W,	Carbon film	0114215	
49	Resistor	R723	3.9 kohm	1/2 W,	Carbon film	F020014T	U
	Resistor	R723	3.9 kohm	1/2 W,	Carbon film	0100007	EABS
50	Resistor	R309*	4.7 ohm,	1/2 W,	Carbon film	F020088T	
51	Resistor	R858	39 ohm,	1/2 W,	Carbon film	F020038G	
52	Resistor	R620	56 ohm,	1/2 W,	Carbon film	F020042	
53	Resistor	R854, R855, R856	150 ohm,	1/2 W,	Carbon film	F020052G	
54	Resistor	R631	470 ohm,	1/2 W,	Carbon film	F020064	
	Resistor	R633	470 ohm,	1/2 W,	Carbon film	F020064T	
	Resistor	R926, R927	470 ohm,	1/2 W,	Carbon film	F020064G	
55	Resistor	R630, R632	680 ohm,	1/2 W,	Carbon film	F020068	
56	Resistor	R618	1.1k ohm,	1/2 W,	Carbon film	F020073G	
57	Resistor	R615, R616	3.3k ohm,	1/2 W,	Carbon film	F020084	
58	Resistor	R955, R956	4.7Mk ohm,	1/2 W,	Metal.	F040201	
59	Resistor	R733	18k ohm,	1 W,	Metal oxide	0110175	
60	Resistor	R923	68k ohm,	1 W,	Metal oxide	F040023	
61	Resistor	R924, R925	120k ohm,	1 W,	Metal oxide	F040022	
62	Resistor	R920	1 ohm,	2 W,	Metal oxide	F040033	
63	Resistor	R922	39 ohm,	2 W,	Metal oxide	0110211	
64	Resistor	R851, R852, R853	910 ohm,	2 W,	Metal oxide	0110244G	
	Resistor	R875, R876, R877	910 ohm,	2 W,	Metal oxide	0110244G	
65	Resistor	R832	3.3k ohm,	2 W,	Metal oxide	0110257G	
66	Resistor	R802	8.2k ohm,	2 W,	Metal oxide	0110267G	
67	Resistor	R720	3.3k ohm,	5 W,	Metal oxide	F040042	
68	Resistor	R701	5.6k ohm,	5 W,	Metal oxide	F040041	

PARTS LIST

*: for Version 1 /★: for Version 2

No.	Component	Symbol no.	Ratings			Parts no.	Remarks
69	Resistor	R724	5.6 ohm,	5 W,	Wire wound	F070011	
70	Resistor	R901	3.9 ohm,	8 W,	Wire wound	0141073	U
71	Resistor	R901	15 ohm,	8 W,	Wire wound	F070051	EABS
72	Resistor	R148, R621	10 ohm,	1/4 W,	Fusible	0119514	
73	Resistor	R634, R718, R740	1 ohm,	1/4 W,	Fusible	0119512	
74	Resistor	R719, R755	2.2k ohm,	1/4 W,	Fusible	0119505	
75	Volume resistor	VR742	500 ohm,	1/2 W,	Wire wound	0162626	
76	Volume resistor	VR142	500 ohm,	1/2 W,	Carbon film	F090121	
77	Volume resistor	VR141	1k ohm,	1/2 W,	Carbon film	F090123	
78	Volume resistor	VR140	5k ohm,	0.1 W,	Carbon film	F090102	
79	Volume resistor	VR920	50k ohm,	0.1 W,	Carbon film	F090103	
80	Volume resistor	VS701	6-VR,	0.1 W,	Carbon film	F090111	Block type
81	Volume resistor	VR640	100 ohm,	1/2 W,	Metal	F090151	
82	Volume resistor	VR628	1k ohm,	1/2 W,	Metal	F090092	
83	Volume resistor	VR301*	500 ohm,	1/2 W,	Metal	F090152	
84	Volume resistor	VR301★	20k−B,	1/2 W,	Metal	F090153	
85	Volume resistor	VR801	50k ohm,	1/2 W,	Metal	F090033	
	Volume resistor	VR811	50k ohm,	1/2 W,	Metal	F090034	
	Volume resistor	VR821	50k ohm,	1/2 W,	Metal	F090035	
86	Volume resistor	R864, VR865	200 ohm,	1/2 W,	Metal	F090061	
87	Capacitor	C140	10 µF,	16 V,	Electrolytic	F190317F	
88	Capacitor	C864	22 µF,	16 V,	Electrolytic	F190318F	
89	Capacitor	C734	33 µF,	16 V,	Electrolytic	F190319	
90	Capacitor	C926, C111	47 µF,	16 V,	Electrolytic	F190320F	
91	Capacitor	C144, C746, C701	100 µF,	16 V,	Electrolytic	F190321F	
92	Capacitor	C613	220 µF,	16 V,	Electrolytic	F190322F	
93	Capacitor	C614	330 µF,	16 V,	Electrolytic	F190323	
94	Capacitor	C716, C611	470 µF,	16 V,	Electrolytic	F190342F	
95	Capacitor	C145	1000 µF,	16 V,	Electrolytic	F190325F	
96	Capacitor	C142	47 µF,	25 V,	Electrolytic	F190333F	
97	Capacitor	C141, C702, C601★	1 µF,	50 V,	Electrolytic	F190355F	
	Capacitor	C305*, C306, C707	1 µF,	50 V,	Electrolytic	F190355F	
98	Capacitor	C920	2.2 µF,	50 V,	Electrolytic	F190356	
99	Capacitor	C737	3.3 µF,	50 V,	Electrolytic	F190357F	
100	Capacitor	C607	4.7 µF,	50 V,	Electrolytic	F190358F	
101	Capacitor	C921	22 µF,	50 V,	Electrolytic	F190360F	
102	Capacitor	C606	33 µF,	50 V,	Electrolytic	F190361F	
103	Capacitor	C301★, C302★	100 µF,	50 V,	Electrolytic	0248724F	
104	Capacitor	C305★, C309★	10000 µF,	50 V,	Electrolytic	0244171F	
105	Capacitor	C608	10 µF,	100 V,	Electrolytic	F190384F	
106	Capacitor	C609, C740	100 µF,	100 V,	Electrolytic	F190388F	
107	Capacitor	C854, C855, C856	4.7 µF,	160 V	Electrolytic	0253455F	
108	Capacitor	C867	10 µF,	160 V,	Electrolytic	F190404F	
109	Capacitor	C724, C744	100 µF,	160 V,	Electrolytic	F190281F	
	Capacitor	C942	100 µF,	160 V,	Electrolytic	F190408F	
110	Capacitor	C910	470 µF,	200 V,	Electrolytic	F190551	U
111	Capacitor	C910	220 µF,	400 V,	Electrolytic	F190561	E,A,B,S
112	Capacitor	C801, C802, C803	4.7 µF,	250 V,	Electrolytic	F190412F	
113	Capacitor	C714	10 µF,	250 V,	Electrolytic	F190413F	
114	Capacitor	C860	150 pF,	50 V,	Ceramic	0244229F	

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No.	Component	Symbol no.	Ratings			Parts no.	Remarks
115	Capacitor	C861	180 pF,	50 V,	Ceramic	0244116F	
116	Capacitor	C862	220 pF,	50 V,	Ceramic	0244230F	
117	Capacitor	C618, C304	560 pF,	50 V,	Ceramic	0244115F	
118	Capacitor	C617	680 pF,	50 V,	Ceramic	0244117F	
119	Capacitor	C704	2200 pF,	50 V,	Ceramic	0244105F	
120	Capacitor	C143, C151, C152	0.01 μF,	50 V,	Ceramic	0244171F	
	Capacitor	C153, C154, C155	0.01 μF,	50 V,	Ceramic	0244171F	
	Capacitor	C122, C602, C868	0.01 μF,	50 V,	Ceramic	0244171F	
	Capacitor	C867, C870	0.01 μF,	50 V,	Ceramic	0244171F	
121	Capacitor	C902, C903	1000 pF,	125 V,	Ceramic	F150261	U
12	Capacitor	C904, C905, C906	4700 pF,	400 V,	Ceramic	0249159	
	Capacitor	C907, C955, C956	4700 pF,	400 V,	Ceramic	0249159	
123	Capacitor	C612	180 pF,	500 V,	Ceramic	F160033F	
124	Capacitor	C709	220 pF,	500 V,	Ceramic	F160034F	
125	Capacitor	C710	820 pF,	500 V,	Ceramic	F160041F	
126	Capacitor	C712	1000 pF,	500 V,	Ceramic	F160042F	
127	Capacitor	C610	4700 pF,	500 V,	Ceramic	F160050F	
	Capacitor	C851, C852, C853	4700 pF,	500 V,	Ceramic	0244565F	
	Capacitor	C857, C858, C859	4700 pF,	500 V,	Ceramic	0244565F	
	Capacitor	C866	4700 pF,	500 V,	Ceramic	0244565F	
128	Capacitor	C923, C927, C944	1000 pF,	1k V,	Ceramic	F160102	
129	Capacitor	C805	1500 pF,	1k V,	Ceramic	F150453	
	Capacitor	C925	1500 pF,	1k V,	Ceramic	F160104	
130	Capacitor	C924	3300 pF	1k V,	Ceramic	F160108	
131	Capacitor	C182, C183, C184	47 pF,	50 V,	Ceramic	0248676	
	Capacitor	C185	47 pF,	50 V,	Ceramic	0248676	
132	Capacitor	C603	1 pF,	25 V,	Ceramic	0292706F	
133	Capacitor	C113	33 pF,	50 V,	Ceramic	0248676	
134	Capacitor	C730	33 pF,	500 V,	Ceramic	F160078F	
135	Capacitor	C110	120 pF,	50 V,	Ceramic	0244228F	
136	Capacitor	C940	180 pF,	2500 V,	Ceramic	0243839	
137	Capacitor	C711	330 pF,	2500 V,	Ceramic	0243837	
138	Capacitor	C703	5600 pF,	50 V,	Polyester film	0279211F	
139	Capacitor	C722	2200 pF,	50 V,	Polyester film	F150102F	
140	Capacitor	C706	0.01 μF,	50 V,	Polyester film	F150118F	
141	Capacitor	C705	0.015 μF,	50 V,	Polyester film	F150122F	
142	Capacitor	C302*, C303*, C604	0.022 μF,	50 V,	Polyester film	F150126F	
	Capacitor	C713	0.022 μF,	50 V,	Polyester film	F150126F	
143	Capacitor	C605, C731	0.033 μF,	50 V,	Polyester film	F150130F	
144	Capacitor	C301*, C922	0.047 μF,	50 V,	Polyester film	F150134F	
145	Capacitor	C901	0.1 μF,	125 V,	Polyester film	F150244	U
146	Capacitor	C780	0.033 μF,	100 V,	Polypro	0299037F	
147	Capacitor	C723	0.1 μF,	200 V,	Polypro	0299926F	
148	Capacitor	C721	0.12 μF,	200 V,	Polypro	0299927F	
149	Capacitor	C719	0.012 μF,	630 V,	Polypro	0299982F	
150	Capacitor	C717, C718	0.01 μF,	630 V,	Polypro	0299981F	
151	Diode	D101, D102	US1040,		Silicon	F380201	
	Diode	D103, D104	US1040,		Silicon	F380201	
	Diode	D105, D111	US1040,		Silicon	F380201	
	Diode	D112, D113	US1040,		Silicon	F380201	
	Diode	D114, D131	US1040,		Silicon	F380201	

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No.	Component	Symbol no.	Ratings	Parts no.	Remarks
	Diode	D132, D133	US1040, Silicon	F380201	
	Diode	D134, D135	US1040, Silicon	F380201	
	Diode	D136, D140	US1040, Silicon	F380201	
	Diode	D141, D161	US1040, Silicon	F380201	
	Diode	D162, D163	US1040, Silicon	F380201	
	Diode	D164, D165	US1040, Silicon	F380201	
	Diode	D166, D191	US1040, Silicon	F380201	
	Diode	D192, D601	US1040, Silicon	F380201	
	Diode	D602, D702	US1040, Silicon	F380201	
	Diode	D703, D718	US1040, Silicon	F380201	
	Diode	D719, D115	US1040, Silicon	F380201	
	Diode	D603	US1040, Silicon	F380201G	
	Diode	D301, D302*	US1040, Silicon	F380201G	
152	Diode	D707	US1090, Silicon	F380631G	
153	Diode	D710	RU1, Silicon	F380651	
154	Diode	D705	RU1A, Silicon	F380652	
155	Diode	D706	RH1S, Silicon	2332251	
156	Diode	D714, D715	V06C, Silicon	2330251	
	Diode	D854, D855, D856	V06C, Silicon	F360281	
157	Diode	D721	V09C, Silicon	2330551	U
158	Diode	D851, D852, D853	1SS82, Silicon	2331912	
159	Diode	D120	SEL1324G, Silicon	F530061	
160	Diode	D720	EU02, Silicon	F410551	
161	Diode	D724, D940	RU2AM, Silicon	F410581	
162	Diode	D922	GFE10, Silicon	F380661	
163	Diode	D722, D723	GFE10R, Silicon	F380751	U
164	Diode	D920, D921	DFC 10, Silicon	F380681	
165	Diode	D901	RB−156LFB, Silicon	F410541	
166	Zener diode	ZD702	HZ4B3	F380427	
167	Zener diode	ZD140	HZ6LB2	2332221	
168	Zener diode	ZD103	HZ2B1	F380378	
169	Zener diode	ZD302★	HZ−12B−2	2331845	
170	Zener diode	ZD701, ZD301★	HZ−36②	F380616	
171	Zener diode	ZD601, ZD602	RD5.1EB1	2334122	
172	Zener diode	ZD101	HZ−7 A/B	2330634	
173	Zener diode	ZD102	HZ−15−1	F380575	
174	Zener diode	ZD920, ZD921	GZB−3.6 B/C	F380681	
175	Zener diode	ZD941	R2M	F380741	
176	IC	IC101	MB7124 or 7123 H/E	F410791	
177	IC	IC102	MD74LS86P	2361881	
178	IC	IC103	MB74LS123M−G	F410694	
179	IC	IC701	HA11423	2364181	
180	IC	IC301*	MB74LS132M−G	F410697	
181	IC	IC301★	74LS73	F410673	
182	IC	IC901	STK−7308A	F410592	
183	IC	IC302*	MB74LS74AM−G	F410674	
184	Transistor	Q701	2SC2271 M/N	2321992	
185	Transistor	Q101, Q131, Q301	2SC458 C/D	2320596	
	Transistor	Q161, Q140, Q171	2SC458 C/D	2320596	

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No.	Component	Symbol no.	Ratings	Parts no.	Remarks
186	Transistor	Q143, Q854	2SC655C/D	F360281	
	Transistor	Q855, Q856	2SC655C/D	F360281	
187	Transistor	Q142	2SC3179Y/G	F360141	
188	Transistor	Q851, Q852, Q853	2SC2911(S/T)	F360151	
189	Transistor	Q702	2SC3026	F360341	U
190	Transistor	Q601, Q602	2SD386A	F360121	
191	Transistor	Q920	2SD1207	F360231	
192	Transistor	Q141	2SD468C	F360161	
193	Transistor	Q702	2SD1397	F360171	E,B,A,S
194	Coil	L701	Heater choke coil 0.35 µH	2120333	
195	Coil	L708, L724	Filter coil 22 µH	2122094	
196	Coil	L141, L745, L857	Filter coil 100 µH	2120482	
197	Coil	L710	Filter coil 3300 µH	2120484	
198	Coil	L901, L902	Line filter	F330051	
199	Coil	L702	H. SIZE	F320043	
200	Coil	L703	H. LIN	F320052	
201	Coil	L854, L855, L856	4.7 µH Axial	2122235T	
202	Coil	L851, L852	10 µH Axial	2122239T	
203	Coil	L853	100 µH Axial	2122253T	
	Coil	L151, L152, L153	100 µH Axial	2122253F	
	Coil	L154, L155	100 µH Axial	2122253F	
204	Transformer	T701	H. DRIVE	2260071	
205	Transformer	T702	Pin cushion transformer	F330041	
206	Transformer	T901	Switching transformer	F290074	
207	Transformer	T703	Flyback transformer	F310053	
208	Switch	S101	DIP switch	F470081	
209	Switch	S601	SLWK22	F470031	
210	Switch	S102	Multiple switch J−K2188	F470051	
211	Connector	CN101	TCS4480−01−1011	F500051	
212	Thermister	TH901	PTC thermister 120 V	F400001	U
213	Thermister	TH901	PTC thermister 200 V	2340471	E,B,A,S
214	Fuse	F701	Fuse TSCR 0.63 A	F690031	
215	Fuse	F901	Fuse ST3 3.15 A	2720902	U
216	Fuse	F901	Fuse SET 3.15 A	2720402	E,B,A,S